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Comparison of the Kinetics of Sebum Secretion in Young Women with and without Acne

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Abstract. We utilized a sebum-sensitive adhesive film, Sebutape®, to visualize the pore patterns of women with and without acne with computerized image analysis. In normal young women, we found a positive correlation between the number of active sebaceous follicles and total sebum excretion. When seborrhea was intense, this correlation was however lost. The situation was more complex in acne. The severity of seborrhea was positively correlated with the mean sebum excretion of individual follicles but not with the number of active follicles.

In many studies conducted over the past years, the activity of sebaceous glands has been evaluated by measuring the sebum excretion rate on large surfaces of the skin compared to the size of the follicular openings. As a consequence the information concerning the activity of individual sebaceous follicles remains poorly understood. Recently the Sebutape® technique was introduced to measure the follicular sebum excretion rate of each individual gland [1, 2].

The aim of this work is to correlate the sebum excretion with the number of active sebaceous follicles in normal and acneic young women.

Materials and Methods

Pore patterns were obtained utilizing a sebum-sensitive tape (Sebutape®; Cuderm Corp., Dallas, Tex., USA), a polymeric film containing innumerable air-filled microcavities. An adhesive coating fixes the tape to the skin during the collection period. The sebum issuing from individual follicles replaces air with lipids, which in reflected light appear as circular black spots. The size of each spot is proportional to the volume of sebum excreted.

The lateral forehead was defatted with ether. The Sebutape was applied for 1 h and then placed on a glass slide. The number and size of sebum spots were determined by means of a computerized image analyzer (MOP Videoplan Kontron, Eching, FRG) after projection of the pattern onto a digitizer tablet. This enabled us to compute the number of active sebaceous follicles per square centimeter and the total sebum excretion rate (TSER) expressed as the total area occupied by the spots per unit of surface.

This study was conducted in Liège during the winter. Two groups of women were studied. The first comprised 50 normal women, aged 23–32 years, and women with untreated acne, aged 19–27 years, comprised the second group. Twenty of these had mild acne, grade 0.25 according to the Leeds scale [3]. The rest had moderate acne with grades ranging from 1.5 to 2.0.

In the normal group, 188 determinations were made at 4-weekly intervals and the results pooled. In the acne group, 66 measurements were made (2 determinations in 16 women and 1 in the remaining 34). Differences between the groups were statistically analyzed by the Mann-Whitney U test. We also considered the coefficient of variation representing the ratio expressed in percent between standard deviation and mean.

Results

Normals

The relationship between TSER and the density of spots is presented in figure 1a combining data within and between persons. We found that the gross distribution of the values remained the same whether or not the data

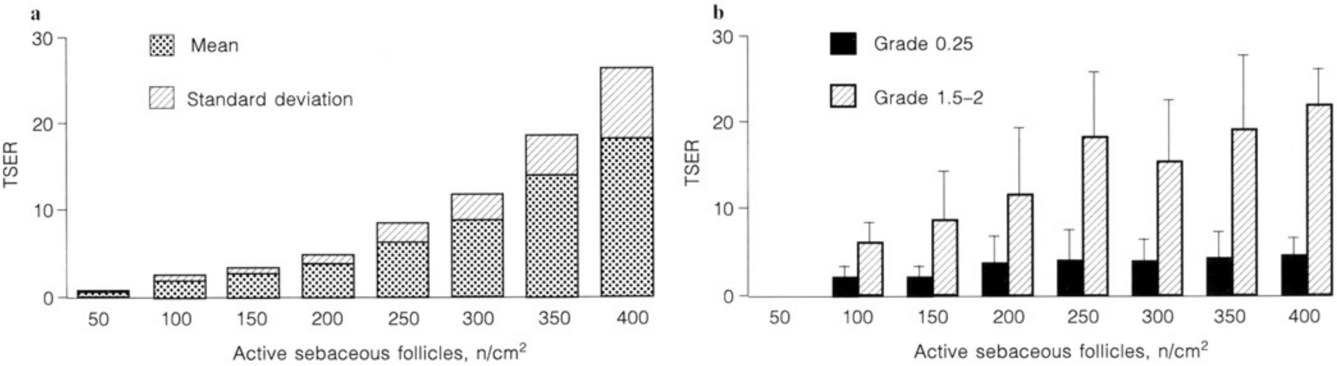

Fig. 1. Relationship between the number of active sebaceous follicles and the total sebum excretion rate (TSER) evaluated by the Sebutape method. **a** Acne-free women; the TSER is proportional to the density of active follicles. **b** Women with acne; in low-grade acne with comedones the TSER is actually lower than in normals, while in medium-grade acne the TSER is higher than normal when the density of active follicles is lower than 300/cm^2.

were combined in this way. When the TSER was low, the sebum output was proportional to the number of active follicles. When seborrhea was more intense (200–250 spots/cm^2) this correlation became exponential. The coefficient of variation of the TSER increased as the density of spots increased, ranging from 12 to 46%.

Acne Patients

The range of variation in the number of active sebaceous follicles was almost similar in normal and acneic patients.

In patients with low-grade acne (0.25 Leeds score), the TSER did not increase significantly with the number of sebaceous active follicles (fig. 1b). Moreover, the TSER was lower ($p<0.05$) than that of normal women (fig. 1a) with densities higher than 150 spots/cm^2.

In women with moderate acne the TSER was significantly ($p<0.05$) higher than normal. It was also higher than in those with low-grade acne ($p<0.01$). This was true independently of the number of spots.

Discussion

These data confirm the reliability of the Sebutape method for evaluating the factors which control the seborrheic state. In contrast to previous methods [4, 5] which yield a single value, the overall sebum output, the Sebutape method provides detailed information relating the density of active follicles to the sebum production. The Sebutape analysis of pore patterns furnishes insights which are marked by gravimetric assessments. For example, the patterns vary with age [6]. Also, in acne the intensity of seborrhea turns out to reflect the high sebum output of a small number of 'gushers' [7]. This contrasts with nonacne seborrhea in which the pore pattern is more uniform [1, 2, 8]. Additionally, the method taught us that the output of individual follicles varies over time [9]. Very active follicles may become almost quiescent and vice versa. These dynamics are important in understanding the occurrence and flow of disease.

The present data emphasize that sebum production is influenced both by the number of active follicles and their individual capacity to excrete sebum. When sebum output is low, the TSER is proportional to the number of active follicles. In seborrhea however, sebum production is no longer only influenced by the number of active follicles. Many of them individually secrete sebum in abundance.

A subtle feature with respect to what appears to be large spots is that these may originate from the coalescence of adjacent follicles. Coalescence is most likely when seborrhea is intense or when Sebutapes are left for 3 h [8], instead of 1 h as in this study.

Our data in acne patients reveal significant changes in TSER according to the clinical grading scale. This is in agreeement with previous statements [10–12]. It must however be emphasized that the range of variations of TSER in both normal and acneic women is large with much overlap of the data. We have seen that the increased TSER with increasing severity of acne is probably unrelated to an increased number of active sebaceous follicles even if the phenomenon of confluence of spots on Sebutape is more prominent in acne [7, 8].

The low TSER in low-grade acne with comedones deserves comment. The probable explanation is that the formation of larger horny impactions is correspondingly associated with regression of the sebaceous glands, the comedo itself being not simply an obstruction to the outflow of sebum. The presence of a large number of comedones could therefore parallel a lower sebum output [8, 13, 14].

In conclusion, the regulation of the TSER in normal young women depends on the number and on the activity of sebaceous follicles, these two latter factors varying in parallel. The severity of seborrhea and acne most probably depends on an increased excretion of sebum by a few glands rather than on an increased number of active sebaceous follicles.

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